

CLAIMS

I claim:

1. A magnetically permeable plate for use as the front plate of a magnetic flux path assembly of a loudspeaker, the loudspeaker having a diaphragm driven by a voice coil, the magnetic flux assembly having a pole piece, a magnet, and a magnetic flux path between one pole of the magnet and the pole piece, wherein:

said plate has an opening defined therein sized to fit about the pole piece and to co-operate with the pole piece to define a gap for accommodating movement of the voice coil therebetween; and

said top plate has venting defined therein to permit fluid communication through said plate external to the voice coil.

2. The plate of claim 1 wherein said plate has an outer periphery, an inner periphery defining said opening, and said venting is segregated from said inner periphery.

3. The plate of claim 2 wherein said plate has the form of a disc in which said inner and outer peripheries are circular and concentric.

4. The plate of claim 3 wherein said venting includes an array of apertures spaced outwardly from, and having a pitch circle concentric with, said inner periphery.

5. The plate of claim 4 wherein said apertures are circular.

6. The plate of claim 1 wherein said opening has a nominal periphery and said venting includes at least one rebate let into said nominal periphery.

7. The plate of claim 1 wherein said opening has a crenellated profile.

8. A magnetic flux path assembly for a loudspeaker having a diaphragm, a voice coil for driving the diaphragm and a diaphragm cavity defined therewithin, wherein:

said magnetic flux path assembly has a pole piece, an opposed member placed in spaced relationship from the pole piece to define a gap for

accommodating reciprocation of the voice coil, and at least one intermediate member mounted to maintain the position of said pole piece and said opposed member relative to each other;

said pole piece, said intermediate member, and said opposed member co-operating to form a continuous path of higher magnetic permeability than said gap;

at least one of said pole piece, said at least one intermediate member, and said opposed member includes a magnet for establishing a magnetic flux in said magnetic flux path assembly and across the gap;

said magnetic flux path assembly has an airflow path defined therein extending between the dust cap cavity and external ambient, for permitting displacement of air between the cavity and external ambient; and

at least a portion of said airflow path is defined in said opposed member external to said gap,

whereby displacement of air by the dust cap member causes motion of air in said portion of said airflow path to encourage cooling of said opposed member.

9. The magnetic flux path assembly of claim 8 wherein said opposed member is a plate having an outer periphery, a closed inner periphery defining an opening extending about said pole piece, said gap lying between said periphery and said pole piece, and said portion of said airflow path is formed in said plate and is segregated from said opening.

10. The magnetic flux path assembly of claim 9 wherein said plate has the form of a disc in which said inner and outer peripheries are circular and concentric.

11. The magnetic flux path assembly of claim 10 wherein said portion of said airflow path formed in said plate includes an array of apertures spaced outwardly from, and having a pitch circle concentric with, said inner periphery.

12. The magnetic flux path assembly of claim 8 wherein said opposed member is a plate having an outer periphery, a closed inner periphery defining an opening extending about said pole piece, said gap lying between said periphery and said pole

piece, and at least one portion of said inner periphery defines said gap, and another portion of said periphery defines said portion of said airflow path defined in said opposed member.

13. The magnetic flux path assembly of claim 8 wherein:

5
Cm hdn
111
said magnetic flux path assembly has an axis parallel to the direction of reciprocation of the voice coil, said pole piece has a distal region thereof distant from said rigid member, said distal region having the form of a body of revolution concentric with said axis;

10
said opposed member is a plate having a closed inner periphery extending about said pole piece distal region;

said inner periphery has

at least one sector of a circular arc concentric with said distal region, said sector having a radius,

and at least one relief defined in said plate, said relief extending radially outward relative to the radius of said sector;

said gap is defined between said sector and said pole piece; and said relief defines at least a part of said portion of said airflow path defined in said opposed member.

20 14. The magnetic flux path assembly of claim 8 wherein:

said assembly has a central axis;

said pole piece has a round portion;

25 said opposed member is a disc having an outer periphery and a closed inner periphery extending about said round portion of said pole piece;

said inner periphery has a plurality of sectors of a circular arc having a common radius, and a plurality of reliefs defined in said disc extending radially outward relative to the radius of said sectors;

30 said round portion of said pole piece and said sectors are concentric about said axis;

said gap being defined between said sectors and said pole piece, and
said portion of said airflow path being defined, at least in part,
by said reliefs; and
said reliefs and said sectors are arranged in a symmetrical array about
said axis.

15. The magnetic flux path assembly of claim 8 wherein said pole piece includes a
said magnet.

16. The magnetic flux path assembly of claim 8, for a loudspeaker having a round
cylindrical voice coil for driving the diaphragm along an axis of reciprocation, and
supporting structure for mounting the diaphragm to the flux path assembly, wherein:

said opposed piece is a first plate mounted to one portion of said intermediate
member;

said intermediate member has structure extending away from said first plate,
and a second plate mounted to said structure parallel to said first plate;
said first plate has an inner periphery defining an opening, and said pole piece
is mounted to extend at least partially from said second plate toward
said first plate;

said pole piece and said inner periphery co-operate to define a gap for
accommodating reciprocating motion of the voice coil with the pole
piece located internally with respect to the voice coil;

said magnetic flux path assembly has an enclosed space defined between said
pole piece, said structure, and said pair of plates;

said pole piece has a first passageway defined therein to permit fluid
communication between the cavity and said space; and

said first plate has venting defined therein to permit fluid communication
between said space and external ambient.

17. The magnetic flux path assembly of claim 15 wherein:
said magnet has a circular cross-section perpendicular to the axis and a distal
end extending away from said intermediate member;

sub-a) said pole piece has an end cap surmounting said distal end of said magnet, said end cap having a circular cross-section perpendicular to the axis and having a larger diameter than said distal end of said magnet; and said distal end member has passages defined therethrough permitting, in use, fluid communication between the cavity and said space.

18. The magnetic flux assembly of claim 17 wherein said end cap has an external periphery and said passages are channels formed in said periphery.

19. The magnetic flux path assembly of claim 17 wherein said end cap has a round circular periphery and said passages are apertures formed through said end cap.

20. The magnetic flux path assembly of claim 8 wherein said venting includes flow director elements for enhancing convective heat transfer from the voice coil.

21. The magnetic flux path assembly of claim 8 wherein said venting includes at least one deflector for directing airflow toward the voice coil.

22. The magnetic flux assembly of claim 8 wherein said venting includes at least one tube having an outlet oriented to urge air displaced through said tube toward a portion of the voice coil.

23. The magnetic flux assembly of claim 22 wherein said tube is a bent tube having a pair of ends, one of said ends being oriented to urge air displaced through said tube toward a portion of the voice coil during flow in one direction, the other being oriented to urge air displaced through said tube toward a portion of the voice coil during flow in the other direction.

24. The magnetic flux assembly of claim 8, the voice coil having an external surface, wherein:

said opposed member is a plate having a closed inner periphery defining an opening extending about said pole piece, said gap being defined between at least one portion of said periphery and said pole piece;

said venting being defined by another portion of said periphery in the nature of a relief defined in said plate, said relief extending radially away from said pole piece and permitting air to traverse said plate; and said assembly has at least one air guide mounted to said plate to direct air flowing through said relief along at least a portion of the external surface of the voice coil.

5 *sub a)*
25. The magnetic flux path assembly of claim 24 wherein said assembly includes an array of said reliefs and a corresponding array of air guides spaced about the axis.

10 26. The magnetic flux assembly of claim 24 wherein said assembly has an internal enclosed space, and said venting permits air flow between said internal enclosed space and external ambient, and said assembly has associated with at least one said relief, an air guide mounted to extend from one side of said plate, and another air guide mounted to extend away from the other side of said plate.

15 27. The magnetic flux assembly of claim 24 wherein said air guide is a channel having an open longitudinal side facing the voice coil, and said channel extends parallel to the axis.

20 ~~28.~~ A magnetic flux path assembly for a loudspeaker having a diaphragm, a round cylindrical voice coil for driving the diaphragm along an axis of reciprocation, the voice coil and a diaphragm dust cap cavity defined there within, and supporting structure for mounting the diaphragm to the flux path assembly, wherein:

said magnetic flux path assembly has an annular magnet having a pair of annular faces and an inner wall defining an eye therethrough, a first plate mounted to one annular face of said magnet, a second plate mounted to the other annular face of said magnet, and a pole piece;

25 said first plate has an inner periphery defining an opening, and said pole piece is mounted to extend at least partially through said eye from said second plate toward said first plate;

30 said pole piece and said inner periphery co-operate to define a gap for accommodating reciprocating motion of the voice coil with the pole piece located internally with respect to the voice coil;

said magnetic flux path assembly has a space defined between said pole piece,
said inner wall of said magnet, and said pair of plates;
said pole piece has a first passageway defined therein to permit fluid
communication between the cavity and said space; and
5 said first plate has venting defined therein to permit fluid communication
between said space and external ambient.

29. The magnetic flux path assembly of claim 28 wherein said venting includes at
least one aperture defined in said first plate, said aperture being segregated from said
opening.

10 30. The magnetic flux path assembly of claim 28 wherein said periphery includes:
at least one sector of a circular arc, said sector having a radius
measured from said axis; and
a relief defined in said first plate, said relief extending away from said
axis a distance greater than the radius of said sector,
15 whereby said venting is at least partially defined by said relief.

31. The magnetic flux path assembly of claim 28 wherein:
said pole piece is a hollow cylinder having a base end mounted to said
second plate, a distal end for location within the voice coil, and
a wall extending between said ends;
20 said base end is closed, said distal end has an opening defined therein;
and said wall has at least one port defined therein to permit
fluid flow between the cavity and said space through said
cylinder.

32. The magnetic flux path assembly of claim 28 wherein:
25 said pole piece is a post having a base end mounted to said second
plate, a distal end for location within the voice coil, said distal
end having an end face for location facing the cavity, and a wall
extending between said ends, a portion of said wall bounding
said space; and

said pole piece has a passageway defined therein, one end of said passageway terminating at a port defined in said end face of said distal end of said pole piece, said passageway having another end terminating at a port defined in said portion of said wall bounding said space.

33. The magnetic flux path assembly of claim 28 wherein said passageway is a straight bore formed in said pole piece on an inclined angle relative to the axis.

34. The magnetic flux path assembly of claim 32 wherein said passageway has a first bore extending inwardly from said one end of said passageway, and a second bore extending inwardly from said other end of said passageway to intersect said first bore.

35. The magnetic flux path assembly of claim 32 wherein said second bore is a cross-bore extending fully through said pole-piece and having openings at either end thereof.

36. The magnetic flux assembly of claim 28 wherein said pole piece is a post having a base end mounted to said second plate, a distal end for location within the voice coil, said distal end having an end face for location facing the cavity, a medial portion narrower than said distal end and a transition wall extending between said distal end and said medial portion, a portion of said wall bounding said space; and

said pole piece has a passageway defined therein, one end of said passageway terminating at a port defined in said end face of said distal end of said pole piece, said passageway having another end terminating at a port defined in said portion of said wall bounding said space.

37. The magnetic flux assembly of claim 36 wherein said transition wall is chosen from the set of transition walls consisting of:

- (a) an annular shoulder extending radially perpendicular to said axis; and

(b) a truncated conically tapered section; and
said passage is a bore extending parallel to the axis.

38. The magnetic flux path assembly of claim 28 wherein:

5 said pole piece is a post having a base end mounted to said second plate, a distal end for location within the voice coil, said distal end having an end face for location facing the cavity, and a wall extending between said ends, a portion of said wall bounding said space; and

10 said distal end of said pole piece has a sidewall extending parallel to the axis, said sidewall having a radius measured from said axis, and at least one relief defined in said sidewall, said relief extending radially inwardly relative to said radius of said sidewall, and

15 said relief has a first end defined in said end face, and a second end giving onto said enclosed space, whereby air can be displaced along said relief between the cavity and the enclosed space.

39. The magnetic flux path assembly of claim 38 wherein said reliefs in said distal end of said pole piece are grooves formed in said pole piece extending parallel to the axis.

20 40. The magnetic flux path assembly of claim 38 wherein said inner periphery of said first plate includes:

at least one sector of a circular arc, said sector having a radius measured from said axis; and

25 at least one first plate relief defined in said first plate, said first plate relief extending away from said axis a distance greater than the radius of said sector,

whereby said venting is at least partially defined by said first plate relief.

30 41. The magnetic flux path assembly of claim 40 wherein said at least one first plate relief is an array of slots formed in a symmetrical pattern in said first plate relative to the axis, said at least one relief in said pole piece is an array of grooves

formed in said pole piece, the number of slots is equal to the number of grooves, and said slots are aligned opposite said grooves.

42. A loudspeaker comprising:

a diaphragm assembly having a movable membrane, a dust cap mounted to said moveable membrane, a voice coil former, a voice coil formed thereon, and a cavity defined within said dust cap and said former;

a magnetic flux path assembly having a magnet, a flux land connected in a magnetically permeable path to one pole of the magnet, and a pole piece connected in a magnetically permeable path to the other pole of the magnet;

said diaphragm assembly having framing mounted to said magnetic flux path assembly, and having a suspension to permit said voice coil to reciprocate relative to said framing;

said pole piece extending within at least a part of said voice coil; said flux land being located in spaced relationship from said pole piece to define a gap therebetween for accommodating reciprocation of the voice coil, the magnet developing a magnetic flux across the gap;

said loudspeaker having an internal space defined between said pole piece, said magnet, and said flux land;

said pole piece having a passageway defined therein having a port opening on said cavity and another port opening on said space; and

said flux land having venting let therethrough to permit fluid communication between said space and an external environment;

whereby displacement of said dust cap urges fluid to be displaced between said cavity and the external environment along a fluid communication pathway that includes said passageway, said space, and said venting.

43. The loudspeaker of claim 43 wherein a magnetically permeable suspension fluid is introduced into said gap.

44. The loudspeaker of claim 43 wherein said pole piece is a hollow post, said port opening on said cavity being an open end of said post, said port opening on said

space being an aperture let through a sidewall of said post, and said post has a base end, opposite to said open end, said base end being closed.

45. The loudspeaker of claim 44 wherein said pole piece is a post having a groove let along a face thereof, said port opening on said cavity being one end of said spline, and said port opening on said space being another part of said spline.

46. The loudspeaker of claim 46 wherein said pole piece is a post having a longitudinal axis parallel to the direction of reciprocation of said voice coil, and said spline is parallel to said axis.

47. A loudspeaker comprising:

a diaphragm assembly having a movable membrane, a voice coil former, a voice coil formed thereon, and a cavity defined within said membrane and said former;

a magnetic flux path assembly having a magnet, a flux land connected in a magnetically permeable path to one pole of the magnet, and a pole piece connected in a magnetically permeable path to the other pole of the magnet;

said diaphragm assembly being mounted to said magnetic flux path assembly, and having a suspension to permit said voice coil to reciprocate relative to said magnetic flux path assembly;

said pole piece having a post for extending within at least a part of the voice coil;

said flux land being located in spaced relationship from said pole piece to define a gap therebetween for accommodating reciprocation of the voice coil, the magnet developing a magnetic flux field across the gap;

said loudspeaker having an internal space defined between said pole piece, said magnet, and said flux land; and

said flux land having venting let therethrough to permit fluid communication between said space and an external environment.